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By HORTON H. HOBBS, JR., and MARGARET WALTON

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A NEW GENUS AND SIX NEW SPECIES OF ENTOCYTHERID OSTRACODS (OSTRACODA, ENTOCYTHERIDAE)

By Horton H. Hobbs, Jr., and Margaret Walton [1]

The conservatism that marked the supraspecific treatment of this group of epizootic ostracods for 58 years was broken with the establishment of the family Entocytheridae by Howe (1961) and the appearance of a familial revision in the following year by Hart (1962). Even with the elevation of Hoff's (1942) subfamily Entocytherinae in 1961, only two genera were recognized. In his generic revision, however, Hart proposed the recognition of two subfamilies containing 11 genera. We have followed his recommendations and are adding an additional genus to the subfamily Entocytherinae.

At the time of the preparation of this manuscript, descriptions of at least three more genera of entocytherids are in press. Therefore, it seems somewhat futile to offer a key for the separation of established genera that will be obsolete prior to its publication; furthermore, there are undescribed species available to those currently studying these animals which will require the erection of additional genera.

The assemblage of species described here was collected from various areas in the United States, and all of them were associated with crayfishes. The ostracod genera represented are *Dactylocythere*, *Don-*

[1] Hobbs: Department of Zoology, Smithsonian Institution; Walton: 1116 Richmond Blvd., Danville, Va.

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naldsoncythere, *Entocythere*, the new genus *Thermastrocythere*, and *Unicnocythere*.

We wish to thank the following persons who have made available to us the collections on which this paper is based: Messrs. J. W. Berry, C. W. Hart, Jr., J. M. Stubbs, Drs. Fulton Fite, P. C. Holt, L. R. McManus, G. C. Smart, P. J. Spangler, and W. S. Woolcott.

Genus *Dactylocythere* Hart, 1962

Dactylocythere brachystrix, new species

FIGURES 1*a-d*

MALE.—Eye present. Shell (fig. 1*b*) with highest portion posterior to midlength and with dorsal and ventral margins more gently tapered anteriorly than posteriorly; ventral margin of shell entire; submarginal setae anteriorly, ventrally, and posteriorly somewhat evenly spaced, absent dorsally. Range of shell size of 10 specimens recorded in table 1.

Copulatory complex (figs. 1*a*, *d*) with posterior margin of peniferum expanded into three humps; both anteroventral and posteroventral extremities directed anteroventrally. Penis small, its length approximately one-third the anterior-posterior dimension of distal portion of peniferum, and situated at level of base of ventral two-fifths of peniferum. Accessory groove extending dorsally almost to ventral extremity of spermatic duct. Dorsal finger slender with its terminal seta extending to ventral margin of finger guard; ventral finger gently curved throughout its length. Finger guard prominent with its anterior margin straight and its ventral margin emarginate with three small prominences. Clasping apparatus with vertical and horizontal rami somewhat distinctly delimited; vertical ramus with a bend of about 45° just proximal to midlength and joining horizontal ramus (external borders) at an angle of about 100°; internal border or horizontal ramus with three evenly spaced teeth and apex with three denticles; external borders of both rami entire.

FEMALE.—Shell of triunguis female (fig. 1*c*) distinctly larger than that of male, with its greatest height slightly posterior to midlength and distinctly lower anteriorly than posteriorly; ventral margin entire; marginal setae as in male. Prominent J-shaped rod and ruffled amiculum present. Range of shell size of 8 specimens recorded in table 1.

TYPE-LOCALITY AND RANGE.—Otter Creek, Cumberland County, Tenn., approximately 3.5 miles upstream from the Obed River on the Cumberland Plateau. This species is known only from the type locality where it was found associated with *Dactylocythere pachysphyrata*, new species.

TYPES.—The holotypic male, the allotypic female, and a dissected paratypic male are deposited in the U.S. National Museum (nos. 111251, 111252). Paratypes are in the collections of C. W. Hart, Jr., and the joint collection of the authors.

HOST.—An undescribed species of the genus *Cambarus*.

RELATIONSHIPS.—*Dactylocythere brachystrix* is closely related to *D. daphnioides* (Hobbs, 1955), *D. runki* (Hobbs, 1955), *D. chalaza* (Hobbs and Walton, 1962), and *D. pachysphrata*, new species, but differs from all of them in possessing an accessory groove on the peniferum which extends dorsally only to the ventral extremity of the loop of the spermatic duct. In the other species, the groove reaches the dorsal extremity of the loop.

REMARKS.—The name *brachystrix* is derived from the Greek βραχυς, meaning short, and from στριξ, meaning groove, referring to the short accessory groove of the peniferum of the male.

Dactylocythere pachysphyrata, new species

FIGURES 1*e–g*

MALE.—Eye present. Shell (fig. 1*g*) highest posterior to midlength and with dorsal and ventral margins more gently tapered anteriorly than posteriorly; submarginal setae limited largely to anterior, anterodorsal, posterior, and posterodorsal areas, nowhere abundant, rare ventrally, and absent dorsally. Range of shell size of eight specimens recorded in table I.

Copulatory complex (figs. 1*e, f*) with posterior margin of peniferum entire; anteroventral extremity directed ventrally and posteroventral extremity directed anteriorly. Penis small, its length about one-fourth of anterior-posterior dimension of distal portion of peniferum, and situated at level of base of ventral two-fifths of peniferum. Accessory groove extending dorsally to level of dorsalmost extremity of loop of spermatic duct. Dorsal finger moderately stout with its terminal seta extending to ventral margin of finger guard; ventral finger slender, curved throughout its length, somewhat strongly so at base of proximal two-fifths. Finger guard prominent with its anterior margin straight and its ventral margin slightly emarginate but without distinct prominences. Clasping apparatus with vertical and horizontal rami indistinctly delimited by thickened "ankle"; vertical ramus with a bend of about 30° at distal end of proximal two-fifths; internal border of vertical ramus inclined anteroventrally at approximately a 45° angle to main axis; internal border of horizontal ramus with three teeth; apex of clasping apparatus with three denticles; external borders of both rami entire, their posteroventral extensions forming a right angle.

FEMALE.—Unknown.

TYPE-LOCALITY AND RANGE.—Otter Creek, Cumberland County, Tenn., approximately 3.5 miles upstream from the Obed River on the Cumberland Plateau. This species is known only from the type locality where it was found associated with *Dactylocythere brachystrix*.

TYPES.—The holotypic male and a dissected male paratype are deposited in the U.S. National Museum (nos. 111253 and 111254). Paratypes are in the collections of C. W. Hart, Jr., and the joint collection of the authors.

HOST.—An undescribed species of the genus *Cambarus*.

RELATIONSHIPS.—*Dactylocythere pachysphyrata* is related to the same group of species as is *D. brachystrix*. While they share a number of features in common, the most conspicuous is the thickened "ankle" of the clasping apparatus. It is less closely allied to *D. steevesi* (Hart and Hobbs, 1961) in which the vertical ramus of the clasping apparatus is more uniformly thickened. It may be distinguished from *daphnioides* by lacking a posteroventral extension of the shell; from *chalaza* by possessing more than one tooth on the internal border of the clasping apparatus; and from *runki* by possessing a much more prominently thickened "ankle."

REMARKS.—The name *pachysphyrata* is derived from the Greek παχυς, meaning thick, and σφυρον, meaning ankle, referring to the thickened junction of the vertical and horizontal rami of the clasping apparatus of the male.

Genus *Donnaldsoncythere* Rioja, 1942

Donnaldsoncythere cayugaensis, new species

FIGURES 1*h-k*

MALE.—Eye present. Shell (fig. 1*i*) with highest portion posterior to midlength; dorsal margin tapering more gently anteriorly than posteriorly, and ventral margin entire; submarginal setae somewhat evenly, if widely, spaced around entire perimeter of shell. Range of shell size of 10 specimens recorded in table 1.

Copulatory complex (figs. 1*j*, *k*) with peniferum terminating distally in a bilobed rounded prominence; anteroventral margin of posterior lobe thickened. Dorsal and ventral fingers slender and almost straight with terminal seta of dorsal finger reaching level of penis guides on peniferum. Clasping apparatus with distal portion directed at about a 45° angle to basal portion and not clearly divisible into vertical and horizontal rami; margins entire except distal portion of internal border with two teeth and distal extremity with four denticles.

FEMALE.—Shell of triunguis female (fig. 1*h*) much higher than that of male and higher posteriorly than anteriorly; ventral margin with a

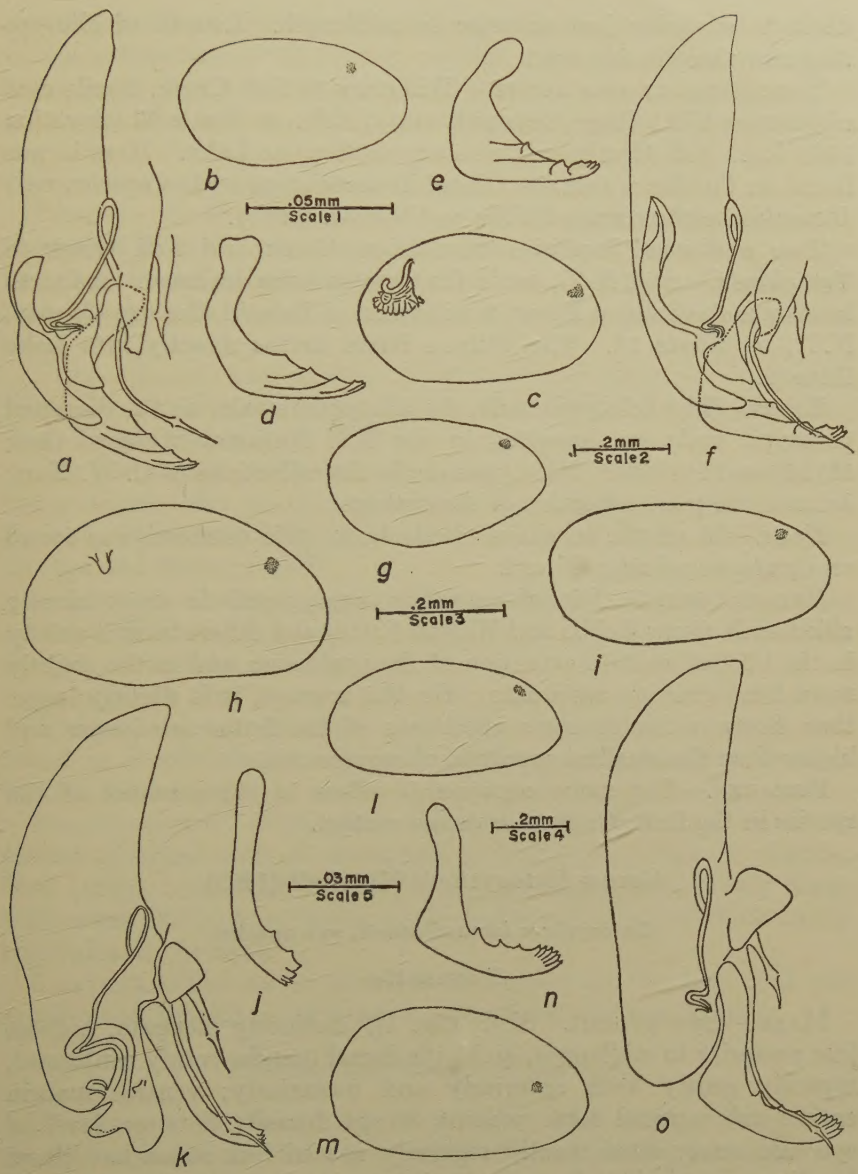

FIGURE 1.—*Dactylocythere brachystrix: a*, copulatory complex of male; *b*, right valve of male; *c*, right valve of triunguis female; *d*, clasping apparatus of male. *Dactylocythere pachysphyrata: e*, clasping apparatus of male; *f*, copulatory complex of male; *g*, right valve of male. *Donnaldsoncythere cayugaensis: h*, right valve of triunguis female; *i*, right valve of male; *j*, clasping apparatus of male; *k*, copulatory complex of male. *Entocythere kanawhaensis: l*, right valve of male; *m*, right valve of triunguis female; *n*, clasping apparatus of male; *o*, copulatory complex of male. (Scale 1: figs. *a, d, e, f, k, n, o;* scale 2: figs. *b, c, g;* scale 3: figs. *h, i;* scale 4: figs. *l, m;* scale 5: fig. *j*.)

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distinct concavity just anterior to midlength. Length of allotype .360 mm.; height .240 mm.

TYPE-LOCALITY AND RANGE.—Tributary to Fall Creek, 1 mile east of Summer Hill Village, Cayuga County, N.Y., on Route 90 (elevation 1440 ft.). Fall Creek is a tributary to Cayuga Lake. Here it was found on *Cambarus robustus* Girard in association with a species near *Donnaldsoncythere scalis* Hobbs and Walton (1963).

Two additional localities on Salmon Creek and Fall Creek in Tompkins County, N.Y., are in the Cayuga Lake drainage. A fourth locality is the Salmon River, 8 miles east of Pulaski, Oswego County, N.Y., on Route 13. The Salmon River drains directly into Lake Ontario.

TYPES.—The holotypic male, the allotypic female, and a dissected paratypic male are deposited in the U.S. National Museum (nos. 111255 and 111256). Paratypes are in the collections of C. W. Hart, Jr., and the joint collection of the authors.

HOST.—In all the localities cited above, this ostracod was found on *Cambarus robustus* Girard.

RELATIONSHIPS.—*Donnaldsoncythere cayugaensis* is most closely allied to *D. ileata* Hobbs and Walton (1963) and differs from it chiefly in the bilobed ventral extention of the peniferum and in the slightly more bent clasping apparatus. On the average, it is slightly larger than *ileata*, although some specimens of the latter are longer and higher than the smallest specimen of *cayugaensis*.

REMARKS.—The name *cayugaensis* refers to the presence of the species in the Lake Cayuga drainage system.

Genus *Entocythere* Marshall (1903)

Entocythere kanawhaensis, new species

FIGURES 1*l-o*

MALE.—Eye present. Shell (fig. 1*l*) distinctly elongate, highest just posterior to midlength, and with dorsal margin evenly contoured, tapering gently both anteriorly and posteriorly; ventral margin entire; submarginal setae present except dorsally between level of eye and anus; setae mostly regularly spaced but somewhat closer together posteriorly. Length of holotype .615 mm., height .300 mm.; length of paratype male .600 mm.; height .300 mm.

Copulatory complex (figs. 1*n*, *o*) with posterior and ventral margins of peniferum entire, the latter rounded; entire peniferum of almost uniform thickness and without ornamentation. Penis small, its length approximately one-fourth the anterior-posterior dimension of distal portion of peniferum, and situated very dorsal to ventral extremity of peniferum. Dorsal finger slender with its terminal seta

reaching level of penis; ventral finger, also slender, and sinuous. Clasping apparatus with distinct vertical and horizontal rami meeting at an angle of approximately 100°. Vertical ramus slightly convex anteriorly with both margins entire; horizontal ramus slightly convex ventrally with external border entire, internal border with three distinct teeth and six apical denticles.

FEMALE.—Shell of triunguis female (fig. 1*m*) proportionately higher than that of male and larger; posterior declivity of dorsal margin more sudden than in that of male; ventral margin entire. Submarginal setae as in male. Length of allotype .698 mm., height .398 mm.

TYPE-LOCALITY AND RANGE.—Rapids in New River at Pembroke, Giles County, Va., where it was associated with *Donnaldsoncythere ileata* Hobbs and Walton (1963).

Two additional specimens were taken from the Cascades on Little Stony Creek, also in Giles County. Here it was associated with *D. ileata*, *D. scalis* Hobbs and Walton (1963), and *Phymocythere phyma* (Hobbs and Walton, 1962).

TYPES.—The holotypic male and the allotypic female are deposited in the U.S. National Museum (no. 111257). A paratype male is in the joint collection of the authors.

HOSTS.—At the type locality, the specimens were taken from *Cambarus sciotensis* Rhoades. At the Cascades the specimen was found in a collection of crayfishes including *C. sciotensis* and *C. b. bartonii* (Fabricius).

RELATIONSHIPS.—*Entocythere kanawhaensis* seems to have its closest affinities with *E. dorsorotunda* Hoff (1944) and *E. elliptica* Hoff (1944) but differs from both species by possessing only three teeth along the internal border of the horizontal ramus of the clasping apparatus of the male.

REMARKS.—The name *kanawhaensis* refers to the fact that the species is an inhabitant of the Kanawha River drainage system.

Thermastrocythere, new genus

DIAGNOSIS.—Terminal tooth of mandible with cusps. Copulatory complex of male without finger guard; ventral portion of peniferum appearing to be deeply incised (actually apparent rami at least partially ensheathed by delicate membrane), its posterior "ramus" slender and curved with apex directed anteriorly, its apparent anterior "ramus" also curved with tip directed ventrally—the two rami appearing to oppose one another; anterior "ramus" consisting of the prominent penis; penis large, its length subequal to anterior-posterior dimension of distal portion of peniferum. Clasping apparatus extending ventrally beyond peniferum with distinct slender vertical

and horizontal rami, the former one-third longer than latter; extensions of rami forming an angle of approximately 80° to 85°; internal and external borders of vertical ramus and external border of horizontal ramus entire; internal border of horizontal ramus with two teeth, one just proximal to midlength and the other subapical; apex with four denticles.

TYPE-SPECIES.—*Thermastrocythere harti*, new species.

REMARKS.—The name *Thermastrocythere* is derived from the Greek θερμαστρις, meaning tongs or pincers, referring to the forcipate appearance of the ventral portion of the peniferum.

Thermastrocythere harti, new species

FIGURES 2*e–g*

MALE.—Eye present. Shell (fig. 2*e*) with highest portion slightly posterior to midlength and with dorsal margin more gently tapering posteriorly than anteriorly; ventral margin of shell entire; submarginal setae present anteriorly, posteriorly, and ventrally but absent dorsally, anterior and anteroventral setae closer together than posterior and posteroventral ones. Range of shell size of 10 specimens recorded in table 1.

Copulatory complex (figs. 2*f*, *g*) as described in the diagnosis. In addition, dorsal finger slender with tip of apical seta reaching level of base of penis; ventral finger with moderate curve near base and a less prominent one a short distance proximal to base of terminal seta.

FEMALE.—Female unknown.

TYPE-LOCALITY, RANGE, AND HOSTS.—Cache Creek at White Wolf Crossing, Fort Sill, Comanche County, Okla., on *Orconectes nais* (Faxon).

Additional localities include: Six Mile Creek near Waunakee, Dane County, Wis., on *Orconectes p. propinquus* (Girard) and *O. virilis* (Hagen): McSpadin Falls, 10 miles northeast of Talequah on Route 10, Cherokee County, Okla., on *Orconectes meeki brevis* Williams, *O. nana* Williams, and *O. neglectus neglectus* (Faxon); small stream, 13 miles west of Madison, Dane County, Wis., on *O. p. propinquus* and *O. virilis;* Yahara River near Sun Prairie where it crosses Route 19, Dane County, Wis., on *O. p. propinquus* and in association with *Entocythere cambaria* Marshall; White Pines State Forest, Ogle County, Ill., on *O. virilis;* and 5.9 miles west of Eyota on Route 14, Olmsted County, Minn., on *Cambarus d. diogenes* Girard and *O. virilis*, in association with *Rhadinocythere serrata* (Hoff).

TYPES.—The holotypic male and two paratypic males are deposited in the U.S. National Museum (nos. 111258 and 111259). Paratypes

are in the collections of C. W. Hart, Jr., and the joint collection of the authors.

RELATIONSHIPS.—*Thermastrocythere harti* has its closest affinities with members of the genus *Uncinocythere* (Hart, 1962) and is perhaps more closely allied to *U. simondsi* (Hobbs and Walton, 1960) than to any other species; similarities exist in the armature of the clasping apparatus and in the distal portion of the peniferum; however, the penis in *harti* reaches the anteroventral extremity of the peniferum—an arrangement that does not exist in any known species of the genus *Uncinocythere*.

REMARKS.—We are pleased to name this species in honor of our friend and colleague, C. W. Hart, Jr., who has contributed much to our knowledge of the entocytherids.

Genus *Uncinocythere* Hart, 1962

Uncinocythere stubbsi, new species

FIGURES 2*a–d*

MALE.—Eye present. Shell (fig. 2*b*) highest near midlength and with dorsal margin evenly contoured anteriorly and posteriorly; ventral margin convex without an emargination; submarginal setae evenly but widely spaced anteriorly, ventrally, and posteriorly, absent dorsally. Range of shell size of 10 specimens recorded in table 1.

Copulatory complex (figs. 2*a*, *d*) with posterior margin of peniferum entire, its ventral margin excised with anteroventral extremity directed ventrally and posteroventral extremity directed anteroventrally; anteroventral portion with a heavy, acute, dorsally directed penis guide. Penis of moderate size, its length approximately one-half anterior-posterior dimension of distal portion of peniferum and situated far distal to base of clasping apparatus within ventral one-third of area between dorsal margin of spermatic loop and ventral extremity of peniferum. Dorsal and ventral fingers slender, latter with strong caudal bend at distal end of proximal one-third. Clasping apparatus with vertical and horizontal rami of subequal lengths, and extensions of their rounded junction forming angle of less than 90°. Vertical ramus entire but with distal one-third curved posteriorly. External border of horizontal ramus gently rounded and entire; internal border with three teeth—largest immediately proximal to midlength and two smaller ones near distal extremity; terminal extremity with three teeth.

FEMALE.—Shell of triunguis female (fig. 2*c*) distinctly larger than that of male with its greatest height slightly posterior to midlength and distinctly lower anteriorly than posteriorly; ventral margin with

emargination near midlength; submarginal setae as in male. Range of shell size of 10 specimens recorded in table 1.

TYPE-LOCALITY AND RANGE.—A tributary of Big Turnbull Creek (to Harpeth and Cumberland Rivers) on the property of Bethany Hills Church Camp in the southern portion of Cheatham County, Tenn.

TABLE 1.—*Measurements (in mm.) of shells*

	Sex	Length	Height	Length/Height
Dac. brachystrix				
Mean	♂	.473±.009	.273±.008	1.73±.031
Minimum	♂	.465	.263	1.67
Maximum	♂	.488	.293	1.78
Mean	♀	.483±.022	.296±.012	1.63±.030
Minimum	♀	.442	.270	1.59
Maximum	♀	.510	.325	1.70
Dac. pachysphyrata				
Mean	♂	.436±.004	.253±.015	1.73±.039
Minimum	♂	.428	.240	1.68
Maximum	♂	.443	.255	1.81
Don. cayugaensis				
Mean	♂	.450±.008	.248±.007	1.82±.062
Minimum	♂	.435	.240	1.71
Maximum	♂	.460	.260	1.92
T. harti				
Mean	♂	.358±.013	.201±.011	1.78±.093
Minimum	♂	.338	.188	1.65
Maximum	♂	.390	.218	1.92
U. stubbsi				
Mean	♂	.281±.008	.161±.003	1.75±.067
Minimum	♂	.270	.158	1.64
Maximum	♂	.293	.165	1.85
Mean	♀	.324±.009	.189±.005	1.74±.113
Minimum	♀	.315	.180	1.62
Maximum	♀	.345	.195	1.83

This species is known only from the type locality.

TYPES.—The holotypic male, the allotypic female, and a dissected paratypic male are deposited in the U.S. National Museum (nos. 111260 and 111261). Paratypes are in the collections of C. W. Hart, Jr., and the joint collection of the authors.

HOST.—*Orconectes rusticus* subsp. (?)

RELATIONSHIPS.—*Uncinocythere stubbsi* has its closest affinities with those species of the genus having a distinct bifid ventral (or posteroventral) margin of the peniferum: *U. ericksoni* (Kozloff, 1955), *U. caudata* (Kozloff, 1955), *U. neglecta* (Westervelt and Kozloff, 1959),

U. simondsi (Hobbs and Walton, 1960), and *U. pholetera* (Hart and Hobbs, 1961). It differs from *U. caudata* in lacking a posteroventral acute projection of the shell; from *U. ericksoni* and *U. neglecta* in possessing only three teeth at the extremity of the ventral ramus of the clasping apparatus; from *U. pholetera* in having the vertical and horizontal rami of the clasping apparatus subequal in length and with the distal two teeth of the horizontal ramus closer together, the distal

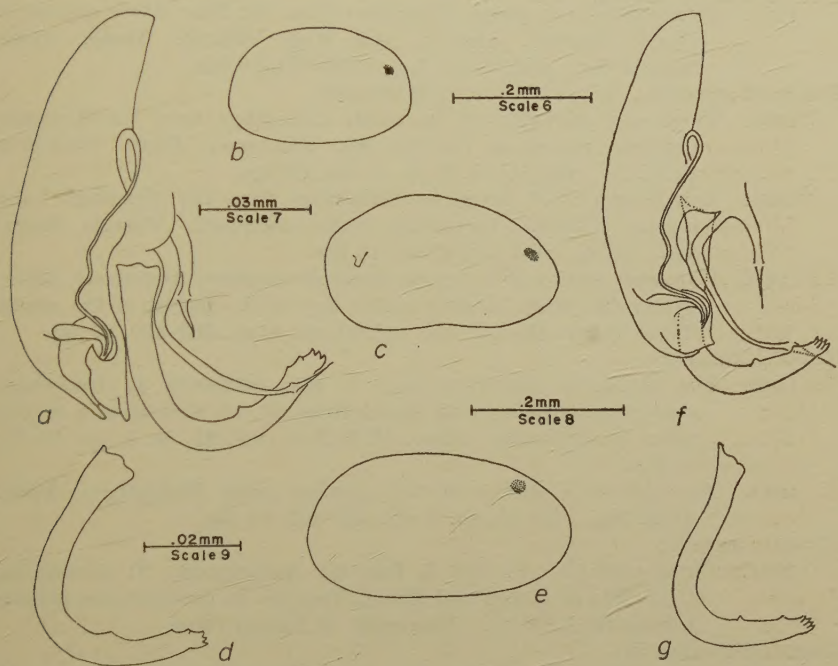

FIGURE 2.—*Uncinocythere stubbsi: a*, copulatory complex of male; *b*, right valve of male; *c*, right valve of female; *d*, clasping apparatus of male. *Thermastrocythere harti: e*, right valve of male; *f*, copulatory complex of male; *g*, clasping apparatus of male.

one more distally situated than in *pholetera;* and from *U. simondsi* in having the penis situated in the distal third of the area between dorsal margin of the spermatic loop and the ventral margin of the peniferum. It differs from all of its relatives in the arrangement of the penis guide.

REMARKS.—It is a pleasure to name this species in honor of John M. Stubbs, of the Tennessee Game and Fish Commission, who has so generously aided us in our studies of crayfishes and their epizootic ostracods in Tennessee.

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